NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Bulk Loading Terminal Ethanol Storage, 500,000 gal, Construction

Reference Flow: 1 piece (pcs) of ethanol storage per kg of fuel dispensed

Brief Description: This unit process models the mass of steel plate and stainless steel used for the construction of ethanol storage tanks with a total capacity of 500,000 gallons at a bulk loading terminal.

Section I: Meta Data

Geographical Coverage: US **Region:** Not Applicable

Year Data Best Represents: 2009

Process Type: Manufacturing Process (MP)

Process Scope: Gate-to-Gate Process (GG)

Allocation Applied: No

Completeness: Individual Relevant Flows Recorded

Flows Aggregated in Data Set:

☒ Process ☐ Energy Use ☐ Energy P&D ☐ Material P&D

Relevant Output Flows Included in Data Set:

Releases to Air:	☐ Greenhouse Gases	☐ Criteria Air Pollutants	☐ Other
Releases to Water:	☐ Inorganic Emissions	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

None.

Tracked Input Flows:

Steel Plate, BF (85% Recovery Rate) [Metals]	*Required carbon steel to build ethanol storage tanks per kg of total fuel dispensed by terminal*
Stainless Steel, 316B (80% Recovery) [Metals]	*Required stainless steel to build ethanol storage tanks per kg of total fuel dispensed by terminal*

Tracked Output Flows:

Ethanol storage per kg of fuel dispensed [Construction] *Reference Flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage4_C_Ethanol_Bulk_Storage_500Kgal_2010.01.xls*, which provides additional details regarding relevant, calculations, data quality, and references.

Goal and Scope

The scope of this unit process encompasses the materials and weights of those materials necessary to construct a pair of vertical storage tanks with a total capacity of 500,000 gallons. This storage capacity is consistent with a bulk loading terminal that dispenses ethanol/gasoline blends of E10 and E85. The process is based on the reference flow of 1 piece of bulk storage tank per kg of fuel dispensed, as described below and as shown in **Figure 1.** The bulk storage tank is assumed to be constructed entirely of carbon and stainless steel; quantities of other materials are assumed to be negligible.

Boundary and Description

The LC boundary of this unit process starts with the construction of a set of vertical bulk storage tanks and ends with a piece of bulk storage tank per kg dispensed fuel (E10 or E85). This unit process represents the construction requirements for an existing bulk loading terminal that is expanded to include the distribution of ethanol fuels. The construction of existing equipment, such as gasoline storage tanks and associated equipment, are not included in this unit process.

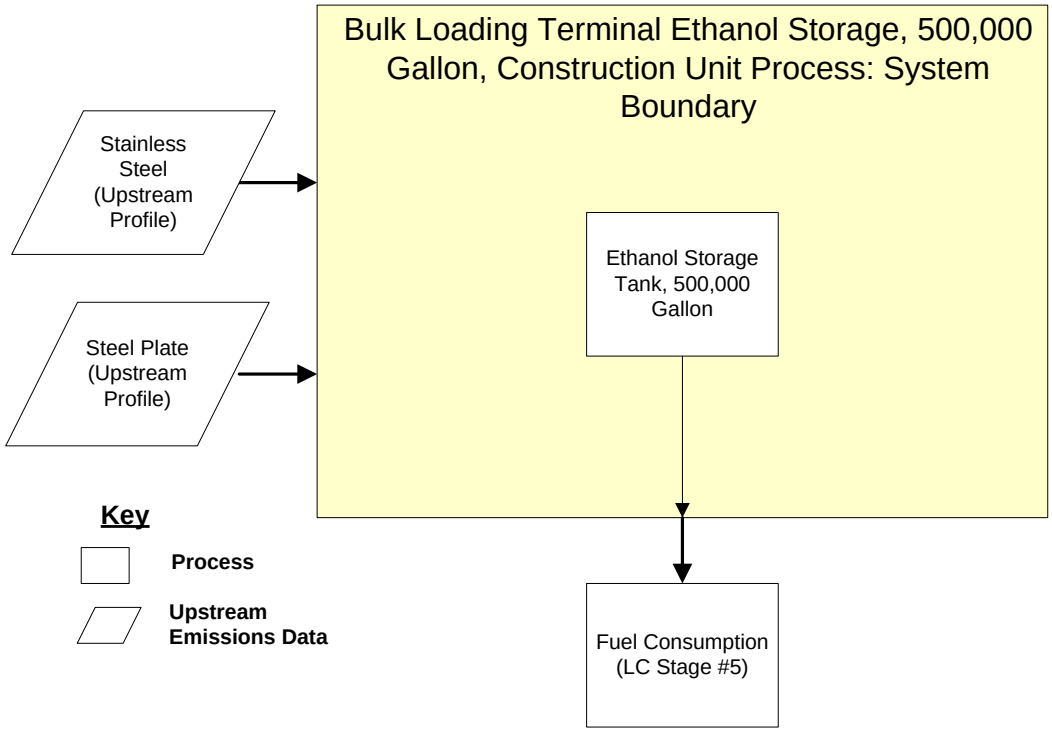
The construction of the bulk storage tank is based on a vertical ground steel tank with a minimum wall thickness of 0.6 centimeters (EEAA 2009). The capacity of the bulk storage tank was calculated based on storage and inventory assumptions. Assuming that the filling time per truck is 20 minutes, operating time per day is 12 hours, capacity of a single truck tanker is 10,000 gallons, and inventory of blended fuel is 2 days, the total storage capacity required of the bulk loading terminal is 720,000 gallons (which includes ethanol and gasoline storage). The portion of this capacity that is attributed to ethanol storage is 500,000 gallons, based on the proportion of ethanol to gasoline contained in E85.

This unit process assumes that ethanol storage is split between two separate tanks, each with a capacity of 250,000 gallons per tank for ethanol. This is the required ethanol storage capacity to be consistent with the total terminal capacity as described above. The tanks are assumed to be vertical cylinders that are 10 meters tall and 0.6 cm thick (EEAA 2009). The ethanol tanks are assumed to be constructed with 50 percent carbon and 50 percent stainless

steel. Material requirements are apportioned over a 30 year facility life. The density of steel is assumed to be 8,000 kg/m^3, and is assumed to be the same between steel plate and stainless steel.

Figure 1 represents the sub-processes contained within the bulk storage facility construction. The figure includes construction directly related to the bulk storage tank that account for steel plate and stainless steel inputs. Upstream processes may require energy or other materials, which are not shown here. Rectangular boxes represent relevant upstream processes, while trapezoidal boxes indicate upstream data that are outside of the boundary of this unit process. As shown, upstream emissions associated with the production and delivery of construction materials are accounted for outside of the boundary of this unit process.

Figure 1: Unit Process Boundary and Scope



Properties of the ethanol storage tanks at a bulk loading terminal are shown in **Table 1**. **Table 2** shows the inputs and outputs of this unit process. Additional details regarding input and output flows, including calculation methods, are contained in the associated DS sheet.

Table 1: Properties of Bulk Loading Terminal Ethanol Storage

Property	Value
Bulk loading terminal total fuel capacity, liters (gal)	2,700,000 (720,000)
Bulk loading terminal operating life, years	30
Number of ethanol tanks per terminal, quantity	2
Ethanol tank volume, liters/tank (gal/tank)	950,000 (250,000)
Ethanol tank weight, kg (lb)	52,000 (113,000)
Ethanol tank steel plate composition, % weight	50%
Ethanol tank stainless steel composition, % weight	50%

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Steel Plate, BF (85% Recovery Rate) [Metals]	**2.22E-06**	**kg**
Stainless Steel, 316B (80% Recovery) [Metals]	**2.22E-06**	**kg**
Outputs		
Ethanol storage per kg of fuel dispensed [Construction]	1	pcs/kg

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. Upstream environmental flows were added during the modeling process using GaBi modeling software, as shown in Figure 1.

Embedded Unit Processes

None.

References

EEAA 2009 — Egyption Environmental Affairs Agency, Table 1: Above Ground Steel Tank Minimium Wall Thickness. 2009. www.eeaa.gov.eg/ehsims/main/wastes/storage_table1.pdf (Accessed February 16, 2010)

Section III: Document Control Information

Date Created: February 15, 2010

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2010). *NETL Life Cycle Inventory Data – Unit Process: Bulk Loading Terminal Ethanol Storage, 500,000 gallons, Construction.* U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: February 2010 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

Section IV: Disclaimer

Neither the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) nor any person acting on behalf of these organizations:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document may not infringe on privately owned rights; or

B. Assumes any liability with this report as to its use, or damages resulting from the use of any information. Apparatus, method, or process disclosed in this document.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by NETL. The views and opinions of the authors expressed herein do not necessarily state or reflect those of NETL.